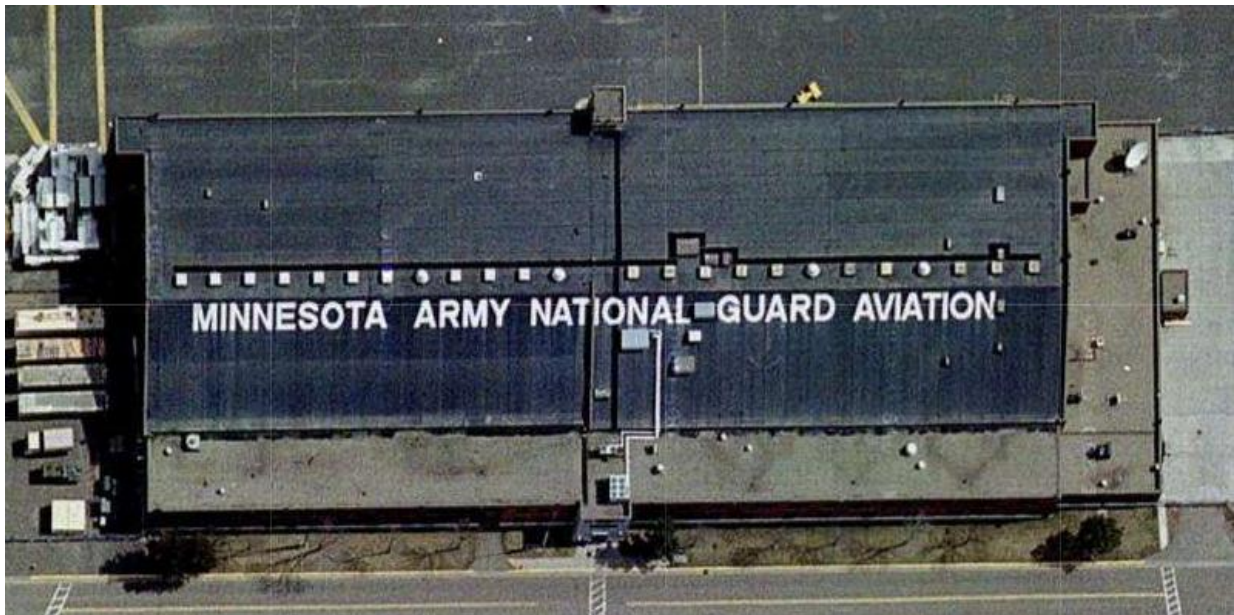


PBEEEP

State Government

Public Buildings Enhanced Energy Efficiency Program

Final Report Investigation Results For AASF Holman Field



Date: 4/26/2012



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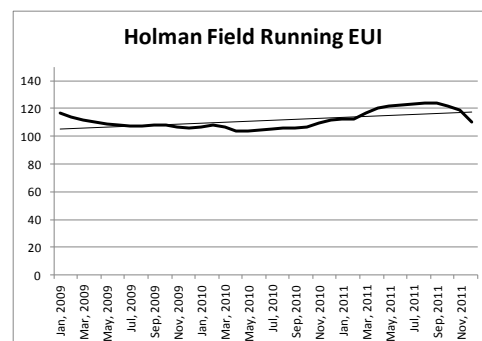
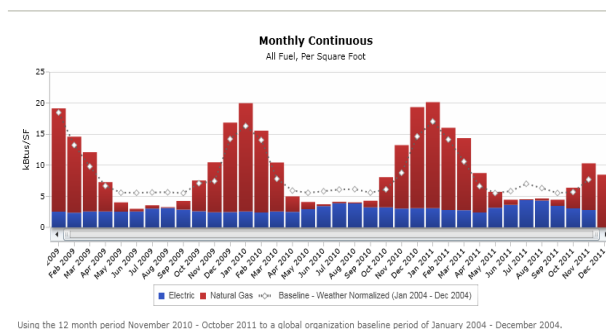
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AASF Holman Field Energy Investigation Overview

The goal of the investigation is to identify energy savings opportunities with a payback of fifteen years or less. Particular emphasis is on finding those opportunities that will generate savings with a relatively fast (1 to 5 years) and certain payback. The PBEEEP Guidelines were used for all systems that were investigated and the calculations were reviewed according to PBEEEP standards. During the investigation phase the provider conducts a rigorous analysis of the system operations. Through observation, targeted functional testing, and analysis of extensive trend data, the RCx Provider identifies deficiencies in the operation of the mechanical equipment, lighting, envelope, and related controls. The investigation of AASF Holman Field was performed by Ericksen, Ellison and Associates, Inc. This report is the result of that information.

Payback Information and Energy Savings			
Total project costs (Without Co-funding)		Project costs with Co-funding	
Total costs to date including study	\$28,861	Total Project Cost	\$50,594
Future costs including Implementation , Measurement & Verification	\$21,733	Study and Administrative Cost Paid with ARRA Funds	(\$28,961)
Total Project Cost	\$50,594	Utility Co-funding	(\$9,975)
		Total costs after co-funding	\$10,758
Estimated Annual Total Savings (\$)	\$7,337	Estimated Annual Total Savings (\$)	\$7,337
Total Project Payback	6.9	Total Project Payback with co-funding	1.5
Electric Energy Savings (27,694 of 1,024,358 kWh (2010))		Natural Gas Savings (6,195 of 71,885 Therms (2010))	
2.7%		8.6%	



STATE OF MINNESOTA B3 BENCHMARKING

AASF Holman Field Consumption Report
Total energy use rose 14% during the period of the study

Summary Tables

Holman Field A.A.S.F.	
Location	206 Airport Rd, St. Paul, MN 55107
Facility Manager	Bob Jeffries
Interior Square Footage	95,329
PBEEEP Provider	Ericksen, Ellison and Associates, Inc.
Annual Energy Cost	\$155,789 (2011) Source: B3
Utility Company	Xcel Energy (Electric and Natural Gas)
Site Energy Use Index (EUI)	107 kBtu/ft ² (at start of study) 122 kBtu/ft ² (at end of study)
Benchmark EUI (from B3) (probably not applicable to this building)	84 kBtu/ft ²

Mechanical Equipment Summary Table	
1	Johnson Controls Metasys Building Automation System
1	Building
9	Air Handlers
38	VAV Boxes
4	Hot Water Boilers (natural gas)
2	Pumps (HW)
375	Approximate number of points available for trending
210	Approximate points required for trending by PBEEEP Guidelines

Implementation Information			
Estimated Annual Total Savings (\$)			\$7,337
Total Estimated Implementation Cost (\$)			\$18,733
GHG Avoided in U.S Tons (CO2e)			58
Electric Energy Savings (kWh) 2.7 % Savings			27,694
2010 Electric Usage 1,024,358 kWh (from B3)			
Electric Demand Savings (Peak kW)			0
NA			
Natural Gas Savings (Therms) 8.6 % Savings			6,195
2010 Natural Gas Usage 71,885 Therms from B3			
Statistics			
Number of Measures identified			11
Number of Measures with payback < 3 years			1
Screening Start Date	10/22/2010	Screening End Date	11/3/2010
Investigation Start Date	6/16/2011	Investigation End Date	4/4/2012
Final Report	4/26/2012	05/03/2012	

AASF Holman Field Cost Information			
Phase		To date	Estimated
Screening		\$1,520	
Investigation [Provider]		\$23,300	
Investigation [CEE]		\$4,041	\$1,000
Implementation			\$18,733
Implementation [CEE]			\$1,000
Measurement & Verification		0	\$1,000
Total		\$28,861	\$21,733

Co-funding Summary	
Study and Administrative Cost	\$28,861
Utility Co-Funding - Estimated Total (\$) {prorated for this site}	\$9,975
Total Co-funding (\$)	\$39,836

Facility Overview

The energy investigation identified five measures with total energy savings of 6.7% at AASF Holman Field. These measures payback in less than 15 years. These measures do not adversely affect occupant comfort. The energy savings opportunities identified at AASF Holman Field are based on adjusting schedules and set points to the actual occupancy schedule of the buildings and installing VFDs on the boiler pumps. The total cost of implementing all the measures is \$18,733.

Implementing all five measures can save the facility approximately \$7,337 a year with a combined payback period of 2.6 years before rebates based on the implementation cost only (excluding study and administrative costs). After rebates the payback is reduced to 1.5 years. These measures will produce 2.7% electrical savings and 8.6% natural gas savings. The building is currently performing at 45% above the Minnesota Benchmarking and Beyond database (B3) benchmark value, however, this benchmark value is based on considering the building to be an automotive maintenance shop, not an airplane hangar, so probably not a good predictor of the expected energy use of the building.

The primary energy intensive systems at AASF Holman Field are described here:

AASF Holman Field in St. Paul, MN is a two story 95,329 square foot (sq.ft) building with offices, storage, and two large aircraft maintenance hangars. The facility is located at the St. Paul Airport.

The building has a hot water boiler plant with four high efficiency natural gas boilers. During the summer one boiler operates to provide reheat. There are several condensing units on the roof to provide cooling to several spaces. Other spaces have window unit A/Cs or no cooling.

All of the mechanical equipment in the building has digital actuation and is controlled by the Johnson Controls Metasys building automation system. Remote computer access is available for setting up and downloading trend data from the automation system. Trending was done remotely and the trend data was exported in CSV format from Camp Ripley (the central energy management point for the Department of Military Affairs).

The majority of interior lighting in the building is comprised of 32W T8 fixtures. Occupancy sensors are present throughout the building. The two hangars were upgraded in 2010 and T5 lighting controlled by day lighting sensors was installed.

The building has one natural gas meter and two electrical meters; one for the main building. In February 2003 a second service was installed to provide 480 V to the Helicopter ground power units, and this service was tapped for additional loads during the 2010 rehabilitation project.



Findings Summary

Building: AASF Holman Field
Site: St Paul AASF

Eco #	Investigation Finding	Total Cost	Savings	Payback	Co-Funding	Payback Co-Funding	GHG
1	Adjust Air Handler Runtime	\$800	\$4,589	0.17	\$0	0.17	34
3	Install Low-Flow Lavatory Aerators	\$1,255	\$1,463	0.86	\$0	0.86	9
4	Adjust Unoccupied Setpoint	\$800	\$221	3.62	\$0	3.62	2
2	Adjust Exhaust Fan Runtime	\$500	\$40	12.52	\$0	12.52	1
5	Boiler System Pump VFDs	\$15,378	\$1,025	15.01	\$0	15.01	13
	Total for Findings with Payback 3 years or less:	\$2,055	\$6,052	0.34	\$0	0.34	43
	Total for all Findings:	\$18,733	\$7,337	2.55	\$0	2.55	58

Investigation Checklist



Rev. 2.0 (12/16/2010)

13600 - Holman Field

This checklist is designed to be a resource and reference for Providers and PBEEP.

Finding Category	Finding Type Number	Finding Type	Relevant Findings (if any)	Finding Location	Reason for no relevant finding	Notes
a. Equipment Scheduling and Enabling:	a.1 (1)	Time of Day enabling is excessive	Occupancy Schedules	AHU-S2,S7,S8		Finding 1
	a.2 (2)	Equipment is enabled regardless of need, or such enabling is excessive	Occupancy Schedules	EF-,7,8,9,12,13		Finding 2
	a.3 (3)	Lighting is on more hours than necessary.	N/A	N/A	Investigation looked for, but did not find this issue.	
	a.4 (4)	OTHER Equipment Scheduling/Enabling	N/A	N/A	Not Relevant	No additional "Other" equipment not addressed by other Findings in category
b. Economizer/Outside Air Loads:	b.1 (5)	Economizer Operation – Inadequate Free Cooling (Damper failed in minimum or closed position, economizer setpoints not optimized)	N/A	N/A	Investigation looked for, but did not find this issue.	Possible finding but the sample group is not large enough to properly confirm.
	b.2 (6)	Over-Ventilation – Outside air damper failed in an open position. Minimum outside air fraction not set to design specifications or occupancy.	N/A	N/A	Investigation looked for, but did not find this issue.	Possible finding but the sample group is not large enough to properly confirm.
	b.3 (7)	OTHER Economizer/OA Loads	N/A	N/A	Not Relevant	No Additional OSA/Economizer Equipment
c. Controls Problems:	c.1 (8)	Simultaneous Heating and Cooling is present and excessive	N/A	N/A	Investigation looked for, but did not find this issue.	
	c.2 (9)	Sensor/Thermostat needs calibration, relocation/shielding, and/or replacement	N/A	N/A	Investigation looked for, but did not find this issue.	
	c.3 (10)	Controls "hunt" and/or need Loop Tuning or separation of heating/cooling setpoints	N/A	N/A	Investigation looked for, but did not find this issue.	
	c.4 (11)	OTHER Controls	N/A	N/A	Investigation looked for, but did not find this issue.	No additional "Other" controls not addressed by other Findings in category
d. Controls (Setpoint Changes):	d.1 (12)	Daylighting controls or occupancy sensors need optimization.	N/A	N/A	Investigation looked for, but did not find this issue.	
	d.2 (13)	Zone setpoint setup/setback are not implemented or are sub-optimal.	Temperature Setpoints	AHU-S2, S7		Finding 3
	d.3 (14)	Fan Speed Doesn't Vary Sufficiently	Yes	S-5, S-7	Not cost-effective to investigate	Some fan speeds do not vary much but the BMS does not have points required to prove calculations.
	d.4 (15)	Pump Speed Doesn't Vary Sufficiently	N/A	N/A	Not Relevant	No variable speed pumps at facility
	d.5 (16)	VAV Box Minimum Flow Setpoint is higher than necessary	N/A	N/A	Not cost-effective to investigate	The BMS does not have points required to prove VAV minimums
	d.6 (17)	Other Controls (Setpoint Changes)	N/A	N/A	Not Relevant	No additional "Other" controls not addressed by other Findings in category
e. Controls (Reset Schedules):	e.1 (18)	HW Supply Temperature Reset is not implemented or is sub-optimal	N/A	N/A	Not Relevant	HWS-T already resets.
	e.2 (19)	CHW Supply Temperature Reset is not implemented or is sub-optimal	N/A	N/A	Not Relevant	No chilled water at facility
	e.3 (20)	Supply Air Temperature Reset is not implemented or is sub-optimal	N/A	N/A	Investigation looked for, but did not find this issue.	
	e.4 ()	Supply Duct Static Pressure Reset is not implemented or is sub-optimal	Yes	S-5, S-7		the BMS does not have points required to prove reset calculations.
	e.5 (21)	Condenser Water Temperature Reset is not implemented or is sub-optimal	N/A	N/A	Not Relevant	No condenser water at facility
	e.6 (22)	Other Controls (Reset Schedules)	N/A	N/A	Not Relevant	No additional "Other" equipment not addressed by other Findings in category
f. Equipment Efficiency Improvements / Load Reduction:	f.1 (23)	Daylighting Control needs optimization—Spaces are Over-Lit.	N/A	N/A	Investigation looked for, but did not find this issue.	
	f.2 (24)	Pump Discharge Throttled	N/A	N/A	Investigation looked for, but did not find this issue.	
	f.3 (25)	Over-Pumping	YES	HWP-1, HWP-2		Calculations prove payback exceeds 15 years. See file "xx-VFD Pump-HW pumps.xlsx"
	f.4 (26)	Equipment is oversized for load.	N/A	N/A	Investigation looked for, but did not find this issue.	
	f.5 (27)	OTHER Equipment Efficiency/Load Reduction	N/A	N/A	Not Relevant	No additional "Other" equipment not addressed by other Findings in category
	g.1 (28)	VFD Retrofit - Fans	N/A	N/A	Investigation looked for, but did not find this issue.	

Investigation Checklist



Rev. 2.0 (12/16/2010)

13600 - Holman Field

This checklist is designed to be a resource and reference for Providers and PBEEP.

Finding Category	Finding Type Number	Finding Type	Relevant Findings (if any)	Finding Location	Reason for no relevant finding	Notes
g. Variable Frequency Drives (VFD):	g.2 (29)	VFD Retrofit - Pumps	YES	HWP-1, HWP-2		Calculations prove payback exceeds 15 years. See file "xx-VFD Pump-HW pumps.xlsx"
	g.3 (30)	VFD Retrofit - Motors (process)	N/A	N/A	Investigation looked for, but did not find this issue.	
	g.4 (31)	OTHER VFD	N/A	N/A	Investigation looked for, but did not find this issue.	
h. Retrofits:	h.1 (32)	Retrofit - Motors	N/A	N/A	Investigation looked for, but did not find this issue.	Motors were looked at but paybacks exceeded 15 years.
	h.2 (33)	Retrofit - Chillers	N/A	N/A	Investigation looked for, but did not find this issue.	No chillers at facility
	h.3 (34)	Retrofit - Air Conditioners (Air Handling Units, Packaged Unitary Equipment)	N/A	N/A	Investigation looked for, but did not find this issue.	
	h.4 (35)	Retrofit - Boilers	N/A	N/A	Investigation looked for, but did not find this issue.	Current boilers at 90+% efficient
	h.5 (36)	Retrofit - Packaged Gas fired heating	N/A	N/A	Investigation looked for, but did not find this issue.	
	h.6 (37)	Retrofit - Heat Pumps	N/A	N/A	Investigation looked for, but did not find this issue.	No heat pumps at facility
	h.7 (38)	Retrofit - Equipment (custom)	N/A	N/A	Not Relevant	No custom equipment on site
	h.8 (39)	Retrofit - Pumping distribution method	N/A	N/A	Investigation looked for, but did not find this issue.	
	h.9 (40)	Retrofit - Energy/Heat Recovery	N/A	N/A	Investigation looked for, but did not find this issue.	
	h.10 (41)	Retrofit - System (custom)	N/A	N/A	Not Relevant	No custom systems on site
	h.11 (42)	Retrofit - Efficient Lighting	N/A	N/A	Investigation looked for, but did not find this issue.	
	h.12 (43)	Retrofit - Building Envelope	N/A	N/A	Not cost-effective to investigate	
	h.13 (44)	Retrofit - Alternative Energy	N/A	N/A	Not Relevant	Paybacks for various Solar / Wind systems exceed 15 years.
	h.14 (45)	OTHER Retrofit	Low flow fixtures	Lavs and Showers		Finding 4 Low Flow Lavs and Showers
i. Maintenance Related Problems:	i.1 (46)	Differed Maintenance from Recommended/Standard	N/A	N/A	Investigation looked for, but did not find this issue.	
	i.2 (47)	Impurity/Contamination	N/A	N/A	Investigation looked for, but did not find this issue.	
	i.3 ()	Leaky/Stuck Damper	N/A	N/A	Investigation looked for, but did not find this issue.	
	i.4 ()	Leaky/Stuck Valve	N/A	N/A	Investigation looked for, but did not find this issue.	
	i.5 (48)	OTHER Maintenance	N/A	N/A	Investigation looked for, but did not find this issue.	
j. OTHER	j.1 (49)	OTHER			Not cost-effective to investigate	Seal gap between hanger ceiling and outside wall. Not able to calculate savings.

Findings Glossary: Findings Examples

a.1 (1)	Time of Day enabling is excessive
	<ul style="list-style-type: none"> • HVAC running when building is unoccupied. Equipment schedule doesn't follow building occupancy • Optimum start-stop is not implemented • Controls in hand
a.2 (2)	Equipment is enabled regardless of need, or such enabling is excessive
	<ul style="list-style-type: none"> • Fan runs at 2" static pressure. Lowering pressure to 1.8" does not create comfort problem and the flow is per design. • Supply air temperature and pressure reset: cooling and heating
a.3 (3)	Lighting is on more hours than necessary
	<ul style="list-style-type: none"> • Lighting is on at night when the building is unoccupied • Photocells could be used to control exterior lighting • Lighting controls not calibrated/adjusted properly
a.4 (4)	OTHER Equipment Scheduling and Enabling
	<ul style="list-style-type: none"> • Please contact PBEEEP Project Engineer for approval
b.1 (5)	Economizer Operation – Inadequate Free Cooling
	<ul style="list-style-type: none"> • Economizer is locked out whenever mechanical cooling is enabled (non-integrated economizer) • Economizer linkage is broken • Economizer setpoints could be optimized • Plywood used as the outdoor air control • Damper failed in minimum or closed position
b.2 (6)	Over-Ventilation
	<ul style="list-style-type: none"> • Demand-based ventilation control has been disabled • Outside air damper failed in an open position • Minimum outside air fraction not set to design specifications or occupancy
b.3 (7)	OTHER Economizer/Outside Air Loads
	<ul style="list-style-type: none"> • Please contact PBEEEP Project Engineer for approval
c.1 (8)	Simultaneous Heating and Cooling is present and excessive
	<ul style="list-style-type: none"> • For a given zone, CHW and HW systems are unnecessarily on and running simultaneously • Different setpoints are used for two systems serving a common zone
c.2 (9)	Sensor / Thermostat needs calibration, relocation / shielding, and/or replacement
	<ul style="list-style-type: none"> • OAT temperature is reading 5 degrees high, resulting in loss of useful economizer operation • Zone sensors need to be relocated after tenant improvements • OAT sensor reads high in sunlight
c.3 (10)	Controls "hunt" / need Loop Tuning or separation of heating/cooling setpoints
	<ul style="list-style-type: none"> • CHW valve cycles open and closed • System needs loop tuning – it is cycling between heating and cooling
c.4 (11)	OTHER Controls
	<ul style="list-style-type: none"> • Please contact PBEEEP Project Engineer for approval
d.1 (12)	Daylighting controls or occupancy sensors need optimization
	<ul style="list-style-type: none"> • Existing controls are not functioning or overridden • Light sensors improperly placed or out of calibration
d.2 (13)	Zone setpoint setup / setback are not implemented or are sub-optimal
	<ul style="list-style-type: none"> • The cooling setpoint is 74 °F 24 hours per day
d.3 (14)	Fan Speed Doesn't Vary Sufficiently
	<ul style="list-style-type: none"> • Fan runs at 2" static pressure. Lowering pressure to 1.8" does not create comfort problem and the flow is per design. • Supply air temperature and pressure reset: cooling and heating

d.4 (15)	Pump Speed Doesn't Vary Sufficiently
	<ul style="list-style-type: none"> • Pump runs at 15 PSI on peak day. Lowering pressure to 12 does not create comfort problem and the flow is per design. Low ΔT across the chiller during low load conditions.
d.5 (16)	VAV Box Minimum Flow Setpoint is higher than necessary
	<ul style="list-style-type: none"> • Boxes universally set at 40%, regardless of occupancy. Most boxes can have setpoints lowered and still meet minimum airflow requirements.
d.6 (17)	Other Controls (Setpoint Changes)
	<ul style="list-style-type: none"> • Please contact PBEEEP Project Engineer for approval
e.1 (18)	HW Supply Temperature Reset is not implemented or is sub-optimal
	<ul style="list-style-type: none"> • HW supply temperature is a constant 180 °F. It should be reset based on demand, or decreased by a reset schedule as OAT increases. • DHW Setpoints are constant 24 hours per day
e.2 (19)	CHW Supply Temperature Reset is not implemented or is sub-optimal
	<ul style="list-style-type: none"> • CHW supply temperature is a constant 42 °F. It could be reset, based on demand or ambient temperature.
e.3 (20)	Supply Air Temperature Reset is not implemented or is sub-optimal
	<ul style="list-style-type: none"> • The SAT is constant at 55 °F. It could be reset to minimize reheat and maximize economizer cooling. The reset should ideally be based on demand (e.g., looking at zone box damper positions), but could also be reset based on OAT.
e.4 ()	Supply Duct Static Pressure Reset is not implemented or is suboptimal
	<ul style="list-style-type: none"> • The Duct Static Pressure (DSP) is constant at 1.5" wc. It could be reset to minimize fan energy. The reset should ideally be based on demand (e.g. looking at zone box damper positions), but could also be reset based on OAT.
e.5 (21)	Condenser Water Temperature Reset is not implemented or is sub-optimal
	<ul style="list-style-type: none"> • CW temperature is constant leaving the tower at 85 °F. The temperature should be reduced to minimize the total energy use of the chiller and tower. It may be worthwhile to reset based on load and ambient conditions.
e.6 (22)	Other Controls (Reset Schedules)
	<ul style="list-style-type: none"> • Please contact PBEEEP Project Engineer for approval
f.1 (23)	Lighting system needs optimization - Spaces are overlit
	<ul style="list-style-type: none"> • Lighting exceeds ASHRAE or IES standard levels for specific space types or tasks
f.2 (24)	Pump Discharge Throttled
	<ul style="list-style-type: none"> • The discharge valve for the CHW pump is 30% open. The valve should be opened and the impeller size reduced to provide the proper flow without throttling.
f.3 (25)	Over-Pumping
	<ul style="list-style-type: none"> • Only one CHW pump runs when one chiller is running. However, due to the reduced pressure drop in the common piping, the pump is providing much greater flow than needed.
f.4 (26)	Equipment is oversized for load
	<ul style="list-style-type: none"> • The equipment cycles unnecessarily • The peak load is much less than the installed equipment capacity

f.5 (27)	OTHER Equipment Efficiency/Load Reduction
	<ul style="list-style-type: none"> • Please contact PBEEEP Project Engineer for approval
g.1 (28)	VFD Retrofit Fans
	<ul style="list-style-type: none"> • Fan serves variable flow system, but does not have a VFD. • VFD is in override mode, and was found to be not modulating.
g.2 (29)	VFD Retrofit - Pumps
	<ul style="list-style-type: none"> • 3-way valves are used to maintain constant flow during low load periods. • Only one CHW pumps runs when one chiller is running. However, due to the reduced pressure drop in the common piping, the pump is providing much greater flow than needed.
g.3 (30)	VFD Retrofit - Motors (process)
	<ul style="list-style-type: none"> • Motor is constant speed and uses a variable pitch sheave to obtain speed control.
g.4 (31)	OTHER VFD
	<ul style="list-style-type: none"> • Please contact PBEEEP Project Engineer for approval
h.1 (32)	Retrofit - Motors
	<ul style="list-style-type: none"> • Efficiency of installed motor is much lower than efficiency of currently available motors
h.2 (33)	Retrofit - Chillers
	<ul style="list-style-type: none"> • Efficiency of installed chiller is much lower than efficiency of currently available chillers
h.3 (34)	Retrofit - Air Conditioners (Air Handling Units, Packaged Unitary Equipment)
	<ul style="list-style-type: none"> • Efficiency of installed air conditioner is much lower than efficiency of currently available air conditioners
h.4 (35)	Retrofit - Boilers
	<ul style="list-style-type: none"> • Efficiency of installed boiler is much lower than efficiency of currently available boilers
h.5 (36)	Retrofit - Packaged Gas-fired heating
	<ul style="list-style-type: none"> • Efficiency of installed heaters is much lower than efficiency of currently available heaters
h.6 (37)	Retrofit - Heat Pumps
	<ul style="list-style-type: none"> • Efficiency of installed heat pump is much lower than efficiency of currently available heat pumps
h.7 (38)	Retrofit - Equipment (custom)
	<ul style="list-style-type: none"> • Efficiency of installed equipment is much lower than efficiency of currently available equipment
h.8 (39)	Retrofit - Pumping distribution method
	<ul style="list-style-type: none"> • Current pumping distribution system is inefficient, and could be optimized. • Pump distribution loop can be converted from primary to primary-secondary)
h.9 (40)	Retrofit - Energy / Heat Recovery
	<ul style="list-style-type: none"> • Energy is not recouped from the exhaust air. • Identification of equipment with higher effectiveness than the current equipment.
h.10 (41)	Retrofit - System (custom)
	<ul style="list-style-type: none"> • Efficiency of installed system is much lower than efficiency of another type of system
h.11 (42)	Retrofit - Efficient lighting
	<ul style="list-style-type: none"> • Efficiency of installed lamps, ballasts or fixtures are much lower than efficiency of currently available lamps, ballasts or fixtures.

h.12 (43)	Retrofit - Building Envelope
	<ul style="list-style-type: none"> • Insulation is missing or insufficient • Window glazing is inadequate • Too much air leakage into / out of the building • Mechanical systems operate during unoccupied periods in extreme weather
h.13 (44)	Retrofit - Alternative Energy
	<ul style="list-style-type: none"> • Alternative energy strategies, such as passive/active solar, wind, ground sheltered construction or other alternative, can be incorporated into the building design
h.14 (45)	OTHER Retrofit
	<ul style="list-style-type: none"> • Please contact PBEEEP Project Engineer for approval
i.1 (46)	Differed Maintenance from Recommended/Standard
	<ul style="list-style-type: none"> • Differed maintenance that results in sub-optimal energy performance. • Examples: Scale buildup on heat exchanger, broken linkages to control actuator missing equipment components, etc.
i.2 (47)	Impurity/Contamination
	<ul style="list-style-type: none"> • Impurities or contamination of operating fluids that result in sub-optimal performance. Examples include lack of chemical treatment to hot/cold water systems that result in elevated levels of TDS which affect energy efficiency.
i.3 ()	Leaky/Stuck Damper
	<ul style="list-style-type: none"> • The outside or return air damper on an AHU is leaking or is not modulating causing the energy use go up because of additional load to the central heating and/or cooling plant.
i.4 ()	Leaky/Stuck Valve
	<ul style="list-style-type: none"> • The heating or cooling coil valve on an AHU is leaking or is not modulating causing the energy use go up because of additional load to the central heating and/or cooling plant.
i.5 (48)	OTHER Maintenance
	<ul style="list-style-type: none"> • Please contact PBEEEP Project Engineer for approval
j.1 (49)	OTHER
	<ul style="list-style-type: none"> • Please contact PBEEEP Project Engineer for approval

Findings Details



Building: AASF Holman Field

FWB Number:	13600	Eco Number:	1
Site:	St Paul AASF	Date/Time Created:	4/25/2012

Investigation Finding:	Adjust Air Handler Runtime	Date Identified:	11/15/2011
Description of Finding:	Multiple pieces of equipment operate 24hours a day or operate on an occupied/unoccupied schedule that is excessive and does not represent actual occupied hours. Equipment Affected: AHU-S2 and RE-1, S7, S8 and RE-4.		
Equipment or System(s):	AHU with heating and cooling	Finding Category:	Equipment Scheduling and Enabling
Finding Type:	Time of Day enabling is excessive		

Implementer:	Contractor	Benefits:	Reduced runtime will save energy
Baseline Documentation Method:	Trending of the air handlers and space temperatures (AHU-S2, AHU-S7, AHU-S8.xlsx) and information on equipment schedules pulled from the BMS indicate what the units are currently doing for occupied/unoccupied temperatures and schedules. Discussions with the Owner determined the correct occupied/unoccupied schedule for the space. (See Holman Field Equipment Schedules.xls)		
Measure:	Adjust equipment schedules to match actual occupied periods		
Recommendation for Implementation:	Adjust BMS programming to provide an occupied/unoccupied schedule that matches the facilities actual occupied hours. New hours for AHU-S2, RE-1, AHU-S7, AHU-S8 and RE-4 shall be Mon-Fri 06:00-24:00, Sat 00:00-24:00, Sun 00:00-16:00.		
Evidence of Implementation Method:	Verification of Implementation shall require: The following trend logs of each of the affected air handlers (AHU-S2 and RE-1, AHU-S7, AHU-S8 and RE-4) shall be taken on 15 minute intervals 2 week(s) (IF possible) during heating season (OSA temp <40°F) and for 2 week(s) during the cooling season (OSA temp >80°F) to verify that the air handlers are properly changing modes (occupied/unoccupied): Supply Fan Speed/Status, Space Temperature, Heating Valve Position, Cooling Valve Position, OSA Damper Position		

Annual Electric Savings (kWh):	13,643	Annual Natural Gas Savings (therms):	4,087
Estimated Annual kWh Savings (\$):	\$742	Estimated Annual Natural Gas Savings (\$):	\$3,846
Contractor Cost (\$):	\$300		
PBEEEP Provider Cost for Implementation Assistance (\$):	\$500		
Total Estimated Implementation Cost (\$):	\$800		

Estimated Annual Total Savings (\$):	\$4,589	Utility Co-Funding for kWh (\$):	\$0
Initial Simple Payback (years):	0.17	Utility Co-Funding for kW (\$):	\$0
Simple Payback w/ Utility Co-Funding (years):	0.17	Utility Co-Funding for therms (\$):	\$0
GHG Avoided in U.S. Tons (CO2e):	34	Utility Co-Funding - Estimated Total (\$):	\$0

Current Project as Percentage of Total project			
Percent Savings (Costs basis)	62.5%	Percent of Implementation Costs:	4.3%

Findings Details



Building: AASF Holman Field

FWB Number:	13600	Eco Number:	2
Site:	St Paul AASF	Date/Time Created:	4/25/2012

Investigation Finding:	Adjust Exhaust Fan Runtime	Date Identified:	11/15/2011
Description of Finding:	Multiple pieces of equipment operate 24hours a day or operate on an occupied/unoccupied schedule that is excessive and does not represent actual occupied hours. Equipment Affected: EF-7, EF-8, EF-9, EF-12, EF-13		
Equipment or System(s):	Other	Finding Category:	Equipment Scheduling and Enabling
Finding Type:	Equipment is enabled regardless of need, or such enabling is excessive		

Implementer:	Contractor	Benefits:	Reduced runtime will save energy
Baseline Documentation Method:	Trending of the FANS (EF-7, EF-8, EF-9, EF-12, EF-13.xlsx) and information on equipment schedules pulled from the BMS indicate what the units are currently doing for occupied/unoccupied schedules. Discussions with the Owner determined the correct occupied/unoccupied schedule for the space. (See Holman Field Equipment Schedules.xls)		
Measure:	Adjust equipment schedules to match actual occupied periods		
Recommendation for Implementation:	Adjust BMS programming to provide an occupied/unoccupied schedule that matches the facilities actual occupied hours. See Holman Field Equipment Schedules.xls. Exhaust fan schedules to be Mon-Fri 06:00-24:00, Sat 00:00-24:00, Sun 00:00-16:00.		
Evidence of Implementation Method:	Verification of Implementation shall require: The following trend logs of each of the affected fan (EF-7, EF-8, EF-9, EF-12, EF-13) shall be taken on 15 minute intervals 2 week(s) (IF possible) to verify that the fans are properly changing modes (occupied/unoccupied): Fan Speed/Status.		

Annual Electric Savings (kWh):	734	Contractor Cost (\$):	\$100
Estimated Annual kWh Savings (\$):	\$40	PBEEP Provider Cost for Implementation Assistance (\$):	\$400
		Total Estimated Implementation Cost (\$):	\$500

Estimated Annual Total Savings (\$):	\$40	Utility Co-Funding for kWh (\$):	\$0
Initial Simple Payback (years):	12.52	Utility Co-Funding for kW (\$):	\$0
Simple Payback w/ Utility Co-Funding (years):	12.52	Utility Co-Funding for therms (\$):	\$0
GHG Avoided in U.S. Tons (CO2e):	1	Utility Co-Funding - Estimated Total (\$):	\$0

Current Project as Percentage of Total project			
Percent Savings (Costs basis)	0.5%	Percent of Implementation Costs:	2.7%

Findings Details



Building: AASF Holman Field

FWB Number:	13600	Eco Number:	3
Site:	St Paul AASF	Date/Time Created:	4/25/2012

Investigation Finding:	Install Low-Flow Lavatory Aerators	Date Identified:	11/15/2011
Description of Finding:	Lavatory faucets at the facility do not utilize low flow aerators. Because of this, the lavatories at the facility use more hot water than necessary. If the hot water use is reduced, the energy required to heat the water can be reduced. The current lavatories are hands free single temperature models. The current lavatory flow rate is based on inspection of the existing lavatory aerators.		
Equipment or System(s):	Other	Finding Category:	Retrofits
Finding Type:	Other Retrofit		

Implementer:	Contractor	Benefits:	Lower hot water flow will save energy on hot water heating.
Baseline Documentation Method:	During a site visit, aerators for 50% of the lavatories at the facility were inspected and found to be 2.2 GPM flow style and 50% of the showers had standard 2.5 GPM showerheads.		
Measure:	Replace the aerators and shower heads with lower flow models		
Recommendation for Implementation:	Replace the aerator in each lavatory faucet with a low flow (1.0 GPM) aerator. There are 12 total public lavatories at the facility. Replace the shower head for each shower with a 1.5 GPM showerhead. There are 9 showers.		
Evidence of Implementation Method:	A visual inspection of the lavatories and showerheads will show that the aerators have been properly replaced with lower flow aerators and showerheads		

Annual Natural Gas Savings (therms):	1,555	Contractor Cost (\$):	\$855
Estimated Annual Natural Gas Savings (\$):	\$1,463	PBEEEP Provider Cost for Implementation Assistance (\$):	\$400
		Total Estimated Implementation Cost (\$):	\$1,255

Estimated Annual Total Savings (\$):	\$1,463	Utility Co-Funding for kWh (\$):	\$0
Initial Simple Payback (years):	0.86	Utility Co-Funding for kW (\$):	\$0
Simple Payback w/ Utility Co-Funding (years):	0.86	Utility Co-Funding for therms (\$):	\$0
GHG Avoided in U.S. Tons (CO2e):	9	Utility Co-Funding - Estimated Total (\$):	\$0

Current Project as Percentage of Total project			
Percent Savings (Costs basis)	19.9%	Percent of Implementation Costs:	6.7%

Findings Details



Building: AASF Holman Field

FWB Number:	13600	Eco Number:	4
Site:	St Paul AASF	Date/Time Created:	4/25/2012

Investigation Finding:	Adjust Unoccupied Setpoint	Date Identified:	1/15/2012
Description of Finding:	Multiple pieces of equipment operate 24hours a day or operate on an occupied/unoccupied schedule that is excessive and does not represent actual occupied hours. Equipment Affected: AHU-S2, S7, S8		
Equipment or System(s):	AHU with heating and cooling	Finding Category:	Controls (Setpoint Changes)
Finding Type:	Zone setpoint setup/setback are not implemented or are sub-optimal		

Implementer:	Contractor	Benefits:	Corrected unoccupied setpoint will save energy
Baseline Documentation Method:	Trending of the air handlers and space temperatures (AHU-S2, AHU-S7, AHU-S8.xlsx) and information on equipment schedules pulled from the BMS indicate what the units are currently doing for occupied/unoccupied temperatures and schedules. Discussions with the Owner determined the correct occupied/unoccupied schedule for the space. (See Holman Field Equipment Schedules.xls)		
Measure:	Adjust equipment schedules to correct unoccupied setpoint.		
Recommendation for Implementation:	Adjust BMS programming to reset the unoccupied temperature setpoint during occupied and unoccupied hours. New occupied hours for AHU-S2, AHU-S7, and AHU-S8 shall be: Mon-Fri 06:00-24:00, Sat 00:00-24:00, Sun 00:00-16:00. Setpoints shall be: AHU-S2 Occupied = 72, Unoccupied = 65, AHU-S7 Occupied = 70 heating / 74 cooling, Unoccupied = 65 heating / 78 cooling, AHU-S8 Occupied = 72, Unoccupied = 65.		
Evidence of Implementation Method:	Verification of Implementation shall require: The following trend logs of each of the affected air handlers (AHU-S2, AHU-S7, AHU-S8) shall be taken on 15 minute intervals 2 week(s) (IF possible) during heating season (OSA temp <40°F) and for 2 week(s) during the cooling season (OSA temp >80°F) to verify that the air handlers are properly changing modes (occupied/unoccupied): Supply Fan Speed/Status, Space Temperature, Heating Valve Position, Cooling Valve Position, OSA Damper Position		

Annual Electric Savings (kWh):	927	Annual Natural Gas Savings (therms):	181
Estimated Annual kWh Savings (\$):	\$50	Estimated Annual Natural Gas Savings (\$):	\$170
Contractor Cost (\$):	\$300		
PBEEP Provider Cost for Implementation Assistance (\$):	\$500		
Total Estimated Implementation Cost (\$):	\$800		

Estimated Annual Total Savings (\$):	\$221	Utility Co-Funding for kWh (\$):	\$0
Initial Simple Payback (years):	3.62	Utility Co-Funding for kW (\$):	\$0
Simple Payback w/ Utility Co-Funding (years):	3.62	Utility Co-Funding for therms (\$):	\$0
GHG Avoided in U.S. Tons (CO2e):	2	Utility Co-Funding - Estimated Total (\$):	\$0

Current Project as Percentage of Total project			
Percent Savings (Costs basis)	3.0%	Percent of Implementation Costs:	4.3%

Findings Details



Building: AASF Holman Field

FWB Number:	13600	Eco Number:	5
Site:	St Paul AASF	Date/Time Created:	4/25/2012

Investigation Finding:	Boiler System Pump VFDs	Date Identified:	4/2/2012
Description of Finding:	Currently the heating water system is a constant primary system. Based on trending, there are many times where the load on the boilers is greatly reduced. During those times, the constant volume pumps could be reduced in speed to save energy and still meet the demand on the system. The constant speed operation also contributes to far from optimal efficiency operating conditions for the high efficiency condensing boilers. This effects the following equipment: HWP-1, HWP-2 (Note that only one pump runs at a time, the pumps are fully redundant), Boiler-1, Boiler-2		
Equipment or System(s):	Pump, HW distribution	Finding Category:	Variable Frequency Drives (VFD)
Finding Type:	VFD Retrofit - Pumps		

Implementer:	Contractor	Benefits:	Energy savings
Baseline Documentation Method:	Inspection indicates that no variable speed drives are used on the boiler system pumps.		
Measure:	Add variable speed drives to boiler system pumps.		
Recommendation for Implementation:	Contractor shall install 1 VFD and shaft grounding device on each pump motor (two VFDs and shaft grounding kits total based on Danfoss FC102P7K5T4E21H2) and 2 pipe mounted pressure sensors located 2/3 of the way down the hot water piping system. The contractor shall also modify the VFD programming such that the pumps(s) shall modulate to maintain a differential pressure set point in the hot water piping system. Only one pump shall operate at a time (pumps are fully redundant) and the VFDs shall be capable of alternating the pumps to ensure even usage. The Contractor shall modify 23 existing air handler 3-way valves to close off the bypass direction. Start-up balancing/commissioning shall include a determination of an optimal minimum pressure setpoint that will provide adequate flow to each piece of equipment on the system and reduction of outdoor reset controls setpoints to provide the lowest possible boiler water temperatures in mild weather.		
Evidence of Implementation Method:	Verification of implementation shall include visual inspection and 15 minute trend logs of boiler system load, supply temperature, return temperature, boiler pump VFD speeds, and outdoor temperature during at least two weeks of the heating season over a range of outdoor air temperatures from 50F or higher to 10F or lower. Review of trends should verify that the pump speeds vary appropriately with boiler load and that the boiler system return water temperature is reduced aggressively as the load and outdoor temperature permit.		

Annual Electric Savings (kWh):	12,390	Annual Natural Gas Savings (therms):	372
Estimated Annual kWh Savings (\$):	\$674	Estimated Annual Natural Gas Savings (\$):	\$350
Contractor Cost (\$):	\$11,478		
PBEEP Provider Cost for Implementation Assistance (\$):	\$3,900		
Total Estimated Implementation Cost (\$):	\$15,378		

Estimated Annual Total Savings (\$):	\$1,025	Utility Co-Funding for kWh (\$):	\$0
Initial Simple Payback (years):	15.01	Utility Co-Funding for kW (\$):	\$0
Simple Payback w/ Utility Co-Funding (years):	15.01	Utility Co-Funding for therms (\$):	\$0
GHG Avoided in U.S. Tons (CO2e):	13	Utility Co-Funding - Estimated Total (\$):	\$0

Current Project as Percentage of Total project			
Percent Savings (Costs basis)	14.0%	Percent of Implementation Costs:	82.1%

PBEEEP Military Affairs – Holman Field

The following list of items do not have a sufficiently short payback to be selected as part of the PBEEEP program. However, if modifications to the various systems are being done for other reasons (maintenance, equipment replacement, etc) then these items could be addressed.

-Seal Gap in Hanger Ceiling: The hangers have a gap between the ceiling and the exterior wall where the hanger doors are. This gap allows air to flow from the heated hanger directly up to the unheated attic space above the ceiling insulation.

-VFDs on the Heating Water Pumps: The Heating Water Pumps (HWP-1, HWP-2) are constant volume pumps. Adding Variable Frequency Drives to these pumps will allow these pumps to slow down when the heating load is less than design. This can save pumping energy and increase the temperature difference and efficiency of the boilers. Payback is estimated at 21 years which is outside of the PBEEEP program limits.

-Space temperature set points: As part of this project we have recommended space temperature set points as specified by Army Regulation 420-1. The Owner should implement these set points throughout the remainder of the facility (in those spaces not addressed during the PBEEEP study).

-Supply Pressure Reset: The variable volume air handlers (AHUs S-5, S-8) currently does not utilize supply pressure reset. Supply pressure reset modulates the supply fan speed down until only one VAV box is open to its maximum. This minimizes the amount of fan energy needed during periods of low usage. In order to do this, all of the VAV boxes serving an air handler need to be controlled via a digital BMS.

-Air to air energy recovery: Because of their size, the lower level locker rooms exhaust a very large volume of air whenever that space is in occupied mode. This system takes conditioned air from the space (and odors) and exhausts it out of the building. Then (through an air handler) it brings in fresh air to replace what was exhausted. The efficiency of this process could be greatly improved by installing an air to air energy recovery unit on the roof. This unit would use the exhausted air to pre-temper the intake air and greatly reduce the heating/cooling load on the air handler. Unfortunately, due to initial cost of the equipment and distance from exhaust fan to air handler intake, this has a payback of ~20 years which is outside of the PBEEEP program limits.

-General patching and sealing: Though no major air infiltrations were identified during the site investigations, every building has areas where these leaks tend to develop. We recommend that the Owner (or a Contractor) annually inspect the state of the caulking surround all doors, windows, and other penetrations into the building and replace/patch as needed. A tube of caulking is very cheap and this inspection would be fairly quick. Also, the weather seals on the exterior doors should be inspected annually and these seals should be replaced when they are no longer making good contact with the door. This same annual inspection should also apply to the sealing around the outside perimeter of the building. Though this isn't for energy reasons, it will prevent water from infiltrating the building and causing damage to the lower level of the building.

-Coil Cleaning: Cleaning air handler coils regularly improves their heat transfer and reduces fan energy (blocked/dirty coils require more fan energy to push air through them). Even with filtration at each unit, dirt still builds on the coils.

-Air Handler Supply Temperatures: Data logging shows that many of the units have supply air temperatures that have drifted away from the original design temperatures. While there isn't any energy savings to be had by restoring the original design conditions, the indoor comfort level could likely be improved. If a BMS is installed at the facility as part of this (or another) project, we recommend that the supply air temperature set points from the original design documents be used. We also recommend that the air handler supply temperature set points reset based on the outside air temperature. If the supply air temperature is lower than needed to meet zone cooling requirements, additional energy is used to reheat the air being supplied to the zones that do not have a call for cooling. A reset strategy allows the supply air to rise as the cooling load on the system reduces which lowers reheat energy use.

-Variable speed fans speed: Based on trending of the fan motors of the variable speed air handlers, the fan speeds do not vary as much as would normally be expected. We would expect to see fan speeds that range from ~45% to ~85%. However, trending shows these units all hover at ~85% speed with hardly any variation at all (less than 10% up or down). The associated VAV box dampers may have failed or the VAV minimums are set too high. The BMS does not trend the damper positions so the cause cannot be determined. As individual VAV box dampers close, the static pressure in the ductwork increases. In response to this, the VFD slows the fan speed to maintain a fixed static set point. It is possible that many of the dampers in the VAV boxes have failed in a mostly open position and are not modulating. That would cause the limited changes in fan speed.

-Alternative Energy: Based on pricing and performance information from recent projects, installing a photovoltaic collection system at the facility does not payback within the PBEEEP Program requirements. The payback calculated is ~30 years. At this point, we cannot recommend a photovoltaic installation at this facility. In the future, as the technology gets more efficient and cheaper, this may change. We also investigated the opportunity for using solar thermal energy recovery at the facility. Unfortunately, there is not enough usage of heated water (either for space conditioning or domestic hot water) during the summer to provide a payback for this within the PBEEEP Program requirements.



414 Nicollet Mall, GO-6
Minneapolis, MN 55401

1-800-481-4700
xcelenergy.com

October 25, 2011

**Dept of Military Affairs Holman Field
Bob Jeffries
206 Airport Dr
St. Paul, MN 55107**

Dear Bob :

Thank you for participating in Xcel Energy's Recommissioning program. We have reviewed your study application and proposal and have preapproved your study. The following outlines your rebate and project information:

Building Address	206 Airport Dr		
Study Cost	\$23,300	Study Number	RM1713
Preapproved study rebate*	\$9,975		
* Your rebate was based on the study cost provided. If the final study cost is lower, your rebate will be adjusted accordingly.			
Study Provider	Erickson Ellison and Associates		
Account manager	Barb Jerhoff	Phone	651-229-5565

Here's a quick review of the Recommissioning program process:

- Once your study is complete, your study provider will send a draft copy to us for review.
- After we complete our review and approve the study, we will send you a confirmation letter noting our approval.
- Your study provider will schedule a wrap-up meeting with you and your Xcel Energy account manager to go over the results of the study.
- You pay the study provider for the full cost of the study.
- You submit the Recommissioning Study Rebate Application, along with a copy of the invoice and your Customer Implementation Plan, to us within 3 months of your report presentation. Please work with your account manager to complete the Customer Implementation Plan.
- We'll send your study rebate check to you.



414 Nicollet Mall, GO-6
Minneapolis, MN 55401

1-800-481-4700
xcelenergy.com

Please note that we need to approve the final study in order to receive your study rebate.

This study pre-approval is valid for **3 months** from the date of this letter. If your study will take longer than that, please let us know. If you have any questions or comments, please call your assigned Xcel Energy account manager. Thanks again for participating in our Recommissioning program.

Sincerely,

Alex Birkholz
Marketing Assistant, Recommissioning

Attachment

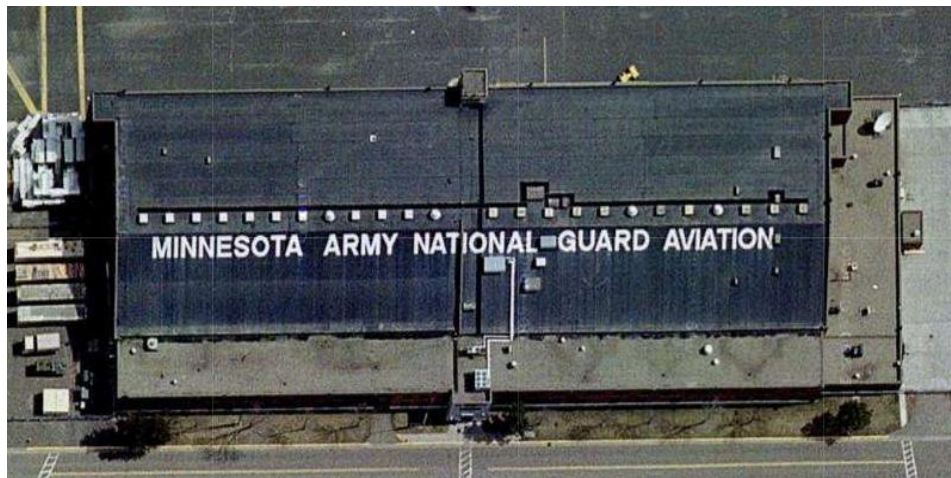
CC: Barb Jerhoff - Xcel Energy
Sherryl Volkert - Xcel Energy
Jason Linquist - Erickson Ellison and Associates

PBEEEP

State Government

Public Buildings Enhanced Energy Efficiency Program

ATTACHMENT 4: SCREENING RESULTS FOR MILITARY AFFAIRS – AASF HOLMAN FIELD



November 3, 2010

1.0 Screening Summary

The goal of screening is to select buildings where an in-depth energy investigation can be performed to identify energy savings opportunities with relatively short (1 to 5 years) and certain payback periods. The screening of AASF Holman Field was performed by the Center for Energy and Environment (CEE) with the assistance of the facility staff. A building walk-through was conducted on October 22, 2010. Additionally, interviews with the facility staff were carried out. These activities were completed to document the status and current conditions of the energy consuming equipment in determining potential for recommissioning. This report is the result of the screening process.

AASF Holman Field in St. Paul, MN is a two story 95,329 square foot (sq.ft) building with offices, storage, and two large aircraft maintenance hangars. The facility is located at the St. Paul Airport.

Table A: Site Summary

AASF Holman Field	
Location	206 Airport Road, St. Paul, MN 55107
Facility Manager	Bob Jeffries
Number of Buildings	1
Interior Square Footage	95,329
PBEEEP Provider	CEE (Gustav Brändström)
Date Visited	October 22, 2010
Annual Energy Cost	\$123,692 (2010)
Utility Company	Xcel Energy (Electric and Natural Gas)
Site Energy Use Intensity (EUI)	107 kBtu/ft ² (2010)
Benchmark EUI (from B3)	84 kBtu/ft ²

2.0 Recommendation for Investigation Phase

The second phase of the PBEEEP project requires the completion of a full energy study to investigate and assess the potential energy savings opportunities identified through the Screening Phase.

An investigation of the energy usage and energy savings opportunities of the building listed below totaling 95,329 interior square feet at AASF Holman Field is recommended.

Table B: Building Summary

Building Name	State ID	Square Footage	Year Built
AASF Holman Field	PD1C9504003	95,329	1930

The following table lists the key mechanical equipment at the facility.

Table C: Mechanical Equipment Summary

Quantity	Equipment Description
1	Johnson Controls Metasys Building Automation System
1	Building
9	Air Handlers
38	VAV Boxes
4	Hot Water Boilers (natural gas)
2	Pumps (HW)
375	Approximate number of points available for trending
210	Approximate points required for trending by PBEEEP Guidelines
0	Data loggers required (does not include lighting or occupancy sensors)

Mechanical Equipment

The building has a hot water boiler plant with four high efficiency natural gas boilers that operate all year. During the summer, one boiler operates to provide reheat. There are several condensing units on the roof to provide cooling to several spaces. Other spaces have window unit A/Cs or no cooling.

Controls and Trending

All of the mechanical equipment in the building has digital actuation and is controlled by the Johnson Controls Metasys building automation system. Remote computer access is available for setting up and downloading trend data from the automation system. Trending is not currently done, but the system is capable of trending and the trend data can be exported in CSV format from Camp Ripley (the central energy management point for the Department of Military Affairs). Camp Ripley can upload the data to WorkZone or other site for retrieval. The points on the automation system for the mechanical equipment are listed in the Building Summary Table below.

Lighting

The majority of interior lighting in the building is comprised of 32W T8 fixtures. Occupancy sensors are present throughout the building. The two hangars were upgraded in 2002 and T5 lighting controlled by day lighting sensors was installed.

Metering

The building has one natural gas meter and two electrical meters; one for the main building and one for the hangars.

Energy Use Index B3 Benchmark

The site Energy Use Index (EUI) for the campus is 108.0 kBtu/sqft, which is about 22% higher than the B3 Benchmark of 84.2 kBtu/sqft. The median site EUI for State of Minnesota buildings are 23% lower than their corresponding B3 Benchmarks on average.

Documentation

There is a significant amount of mechanical documentation, including equipment schedules, mechanical plans, balance reports, and control sequences. Energy management of the facility is the responsibility of an energy manager based out of the Department of Military Affairs Facility Management Office at Camp Ripley in Little Falls.

3.0 Reasons for Recommendation

AASF Holman Field is recommended for the Investigation Phase because its EUI exceeds the benchmark; there is potential for optimization with automated control of HVAC equipment and large air handling units; and there are persistent space comfort complaints indicating the need for optimization.

4.0 Building Summary Table

The following tables are based on information gathered from interviews with facility staff, a building walk-through, automation system screen-captures, and equipment documentation. The purpose of the tables is to provide the size and quantity of equipment and the level of control present in each building. It is complete and accurate to the best of our knowledge.

AASF Holman Field					
Area (sqft)	95,329	Year Built	1930	Occupancy (hrs/yr)	4,056
HVAC Equipment					

Air Handlers

Description	Type	Size	Notes
S-1	MAU	SF 2hp 5,000cfm	Serving Paint Spray Room
S-2	AHU – Constant Volume	SF 1hp 2,760cfm RF 2hp 1,760cfm	Serving South Garage
S-3	MAU	SF 1.5hp 3,600cfm	Serving Welding Room
S-4	AHU – Constant Volume	SF 0.5hp 1,345cfm RF 1hp 1,210cfm	Serving Avionics Room. Has 4.5 Ton DX A/C. Has electric heating coil.
S-5	AHU – VAV	SF 20hp 22,235cfm RF 15hp 20,000cfm	Serves VAVs 1-12 & 24-34. SF and RF both have VFDs. Has 4 stage 55 Ton DX A/C.
S-6	MAU	SF 1.5hp 3,240cfm	Serving Kitchen. 100% OA
S-7	AHU – VAV	SF 7.5hp 12,000cfm	SF and RF both have VFDs.
S-8	AHU – Constant Volume	SF 10hp 15,350cfm RF 7.5hp 8,840cfm	Serving hallways. Heating only.
S-9	AHU – Constant Volume	SF 0.5hp 1,350cfm RF 1hp 1,210cfm	Serving small offices Has 3.5 Ton DX A/C.

VAV Boxes

Description	Type	Size	Notes
38 VAV boxes	34 VAVs 4 VAVs (Fan Powered)	400-1,740cfm 1,200-3,480cfm	HW reheats on all VAVs. Capacity data is available in the building mechanical plans.

Hot Water System

Description	Type	Size	Notes
Boiler 1, 2, 3, 4	High Efficiency HW Boilers	500 & 750 & 1,000 (2X) kBtu/hr	Staged by controller.
Pump 1, 2	Constant Volume HWP's	65 gpm each, 5 hp each	Send water to air handlers

Exhaust Fans

Description	Size	Notes
E-1 through 15	200-5,600cfm (30,860cfm total)	

Points on BAS

Air Handlers

Description	Points
S-1 S-3 S-6	SF-S, DAT and Setpoint, HTG-VLV Pos, Face and By-Pass Damper Pos, OA Damper Command, EF-S
S-2	SF-S, DAT and Setpoint, HTG-VLV Pos, MAT, OA Damper Pos, RA Damper Pos, RF-S, Zone Temp and Setpoint, Occ/Unocc, Economizer Status
S-4	SF-S, DAT, HTG-VLV Pos, Electric Heat Stage 1-4 Status, DX Cooling Status, MAT, OA Damper Pos, RA Damper Pos, RF-S, Zone Temps and Humidity and Setpoints, Occ/Unocc, Economizer Status
S-5	SF-S and Speed, DSP and Setpoint, DAT, HTG-VLV Pos, DX Cooling Stage 1-4 Status, MAT, RAT, OA Damper Pos, RA Damper Pos, RF-S and Speed
S-7	SF-S and Speed, DSP and Setpoint, DAT, HTG-VLV Pos, DX Cooling Stage 1-2 Status, MAT, RAT, OA Damper Pos, RA Damper Pos, RF-S and Speed
S-8	SF-S, DAT and Setpoint, FBP damper Pos, HTG-VLV Pos, MAT, OA Damper Pos, RA Damper Pos, RF-S, Zone Temp and Setpoint, Occ/Unocc, Economizer Status
S-9	SF-S, DAT HTG-VLV Pos, DX Cooling Status, MAT, OA Damper Pos, RA Damper Pos, RF-S, Zone Temp and Setpoint, Occ/Unocc, Economizer Status

VAV Boxes

Description	Points
VAVs	Supply Air Flow and Setpoint, Damper Position, Heating Valve Position, Zone Temp and Setpoint, Occ/Unocc

Hot Water System

Description	Points
	Boiler status (4X), HWST, HWRT, HWP Status (4X), Enable Setpoint,

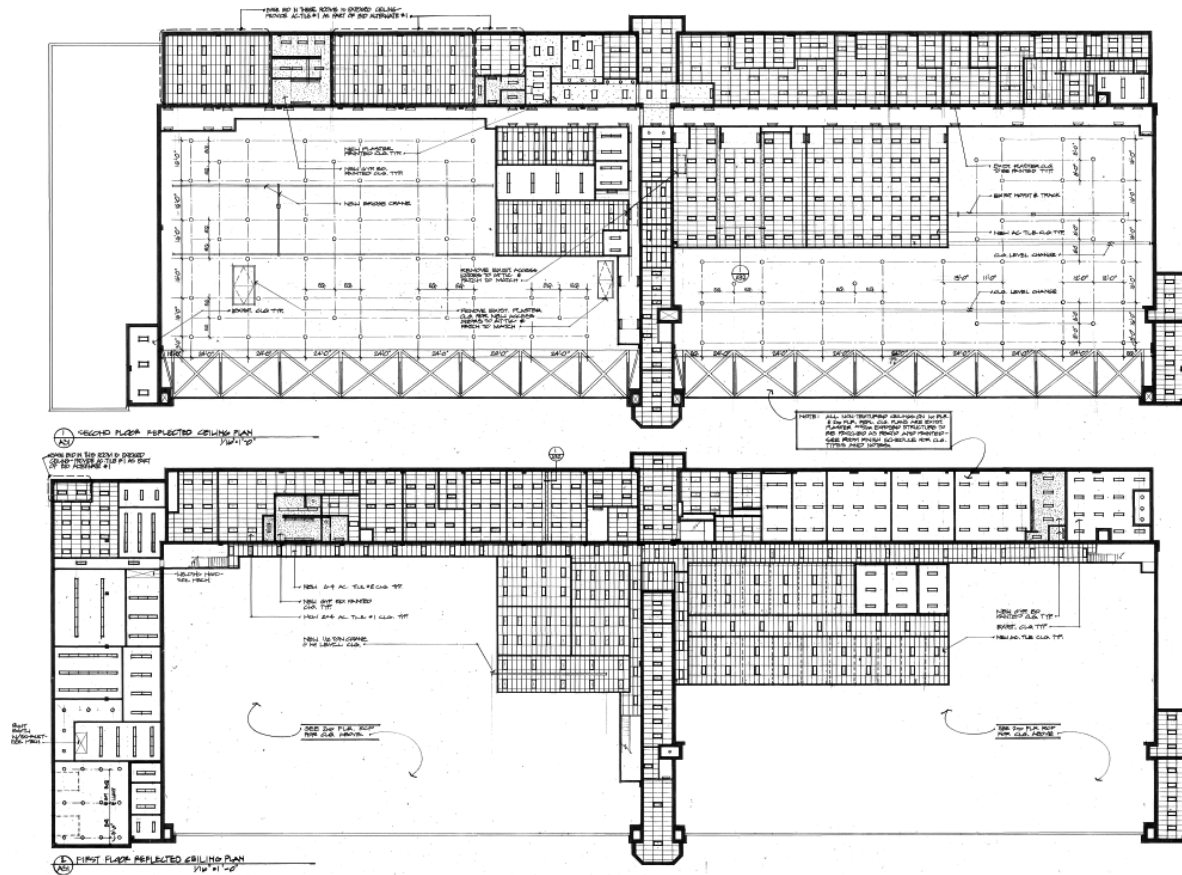
Floor Plans

Description	Points
5 Sections of the building	AHU, VAV, and RHC locations, VAV Space Temperatures, radiation control in basement

Lighting Control

Description	Points
	Several lighting zones in each hangar

P13600 AASF Holman Field Screening Report
11/3/2010



9PBEEEP Abbreviation Descriptions			
AHU	Air Handling Unit	HP	Horsepower
BAS	Building Automation System	HRU	Heat Recovery Unit
CD	Cold Deck	HW	Hot Water
CDW	Condenser Water	HWDP	Hot Water Differential Pressure
CDWRT	Condenser Water Return Temperature	HWP	Hot Water Pump
CDWST	Condenser Water Supply Temperature	HWRT	Hot Water Return Temperature
CFM	Cubic Feet per Minute	HWST	Hot Water Supply Temperature
CHW	Chilled Water	HX	Heat Exchanger
CHWRT	Chilled Water Return Temperature	kW	Kilowatt
CHWDP	Chilled Water Differential Pressure	kWh	Kilowatt-hour
CHWP	Chilled Water Pump	MA	Mixed Air
CHWST	Chilled Water Supply Temperature	MA Enth	Mixed Air Enthalpy
CRAC	Computer Room Air Conditioner	MARH	Mixed Air Relative Humidity
CV	Constant Volume	MAT	Mixed Air Temperature
DA	Discharge Air	MAU	Make-up Air Unit
DA Enth	Discharge Air Enthalpy	OA	Outside Air
DARH	Discharge Air Relative Humidity	OA Enth	Outside Air Enthalpy
DAT	Discharge Air Temperature	OARH	Outside Air Relative Humidity
DDC	Direct Digital Control	OAT	Outside Air Temperature
DP	Differential Pressure	Occ	Occupied
DSP	Duct Static Pressure	PTAC	Packaged Terminal Air Conditioner
DX	Direct Expansion	RA	Return Air
EA	Exhaust Air	RA Enth	Return Air Enthalpy
EAT	Exhaust Air Temperature	RARH	Return Air Relative Humidity
Econ	Economizer	RAT	Return Air Temperature
EF	Exhaust Fan	RF	Return Fan
Enth	Enthalpy	RH	Relative Humidity
ERU	Energy Recovery Unit	RTU	Rooftop Unit
FCU	Fan Coil Unit	SF	Supply Fan
FPVAV	Fan Powered VAV	Unocc	Unoccupied
FTR	Fin Tube Radiation	VAV	Variable Air Volume
GPM	Gallons per Minute	VFD	Variable Frequency Drive
HD	Hot Deck	VIGV	Variable Inlet Guide Vanes

Conversions
1 kWh = 3.412 kBtu
1 Therm = 100 kBtu
1 kBtu/hr = 1 MBH